

Appl. No. 10/601,270
Amdt. dated January 11, 2005
Reply to Office Action of September 16, 2004

AMENDMENTS TO THE CLAIMS

Claims 1-3 and 5 were previously canceled.

Please amend claim 4 and enter new claim 6 as set forth in the following listing of the claims.

Claims 1-3 (cancelled)

4. (currently amended) A method of manufacturing a hollow shaft (b) with a flange (a) at one end thereof, comprising the steps of:

preparing a movable die (17) with an upper recess (17a) on an inside surface thereof and a mandrel (20) at a center position thereof;

placing a fixed die (18) under said movable die (17) with a lower recess (18a) with a same inside diameter of said upper recess (17a) in said ~~on an~~ inside surface thereof;

inserting a steel pipe (19) between said movable die (17) and said fixed die (18);

clamping said steel pipe (19) in a vertical direction by said movable die (17) and said fixed die (18);

engaging said mandrel (20) into said steel pipe (19); and

pressing ~~said~~ the steel pipe (19) while performing a shear spinning treatment on an outer peripheral surface of said steel pipe (19) so as to deform to only reduce an outside diameter thereof until touching thoroughly with an outside surface of said mandrel (20) without changing a thickness of said steel pipe (19) and to integrally form said flange (a), wherein said hollow shaft (b) and said flange (a) are composed of 0.2 - 0.6 wt% of C, 0.01 - 0.1 wt% of Si, 0.05 - 0.5 wt% of Mn, 0.001 - 0.01 wt% of B, 0.01 - 0.1 wt% of Ti or Nb, with the balance being Fe, and are subjected to a heat treatment upon ~~finished forming being combined into an integral body~~, so as to ensure an improved ductility and thus an improved plastic workability.

Claim 5. (cancel)

6. (new) A method of manufacturing a hollow shaft (b) with a flange (a) at one end thereof, comprising the steps of:

preparing a movable die (17) with an upper recess (17a) on an inside surface thereof and a mandrel (20) at a center position thereof;

placing a fixed die (18) under said movable die (17) with a lower recess (18a) on an inside surface thereof, the mandrel extending from the upper recess toward the lower recess, the upper recess having a shoulder encircling an axis of the mandrel with a diameter larger than a diameter of the mandrel, the lower recess having a shoulder encircling the axis of the mandrel with a diameter equal to the diameter of the shoulder of the upper recess for receiving a pipe to be held by the shoulders of the respective recesses;

inserting a steel pipe (19) between said movable die (17) and said fixed die (18), said inserting a step including a step of placing the mandrel within the pipe;

clamping said steel pipe (19) in a vertical direction by displacing said movable die (17) toward said fixed die (18), an inner diameter of said pipe being larger than an outer diameter of said mandrel; and

pressing the steel pipe (19) while performing a shear spinning treatment on an outer peripheral surface of said steel pipe (19) so as to reduce an outside diameter of a portion of the pipe adjacent said movable die to form said shaft, and to integrally form said flange (a) on a portion of the pipe contiguous said fixed die;

wherein said pressing steps are accomplished by moving said movable die toward said fixed die, said shear spinning treatment is accomplished by applying a spinning roll to an outer surface of the pipe and,

wherein said hollow shaft (b) and said flange (a) are composed of 0.2 - 0.6 wt% of C, 0.01 - 0.1 wt% of Si, 0.05 - 0.5 wt% of Mn, 0.001 - 0.01 wt% of B, 0.01 - 0.1 wt% of Ti or Nb, with the balance being Fe, and are subjected to a heat treatment upon being combined into an integral body, so as to ensure an improved ductility and thus an improved plastic workability.